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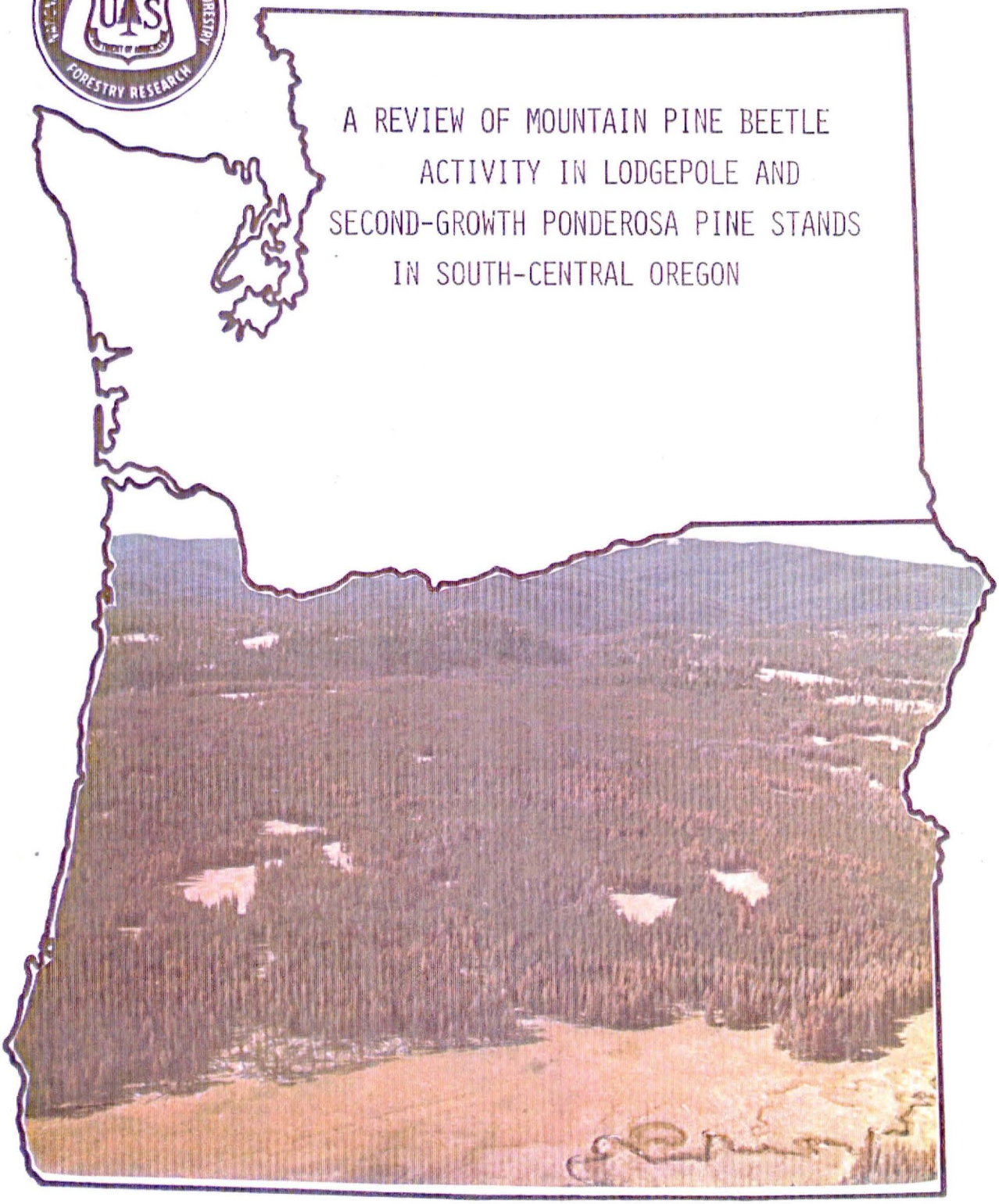

A REVIEW OF MOUNTAIN PINE BEETLE ACTIVITY IN LODGEPOLE AND SECOND-GROWTH PONDEROSA PINE STANDS IN SOUTH-CENTRAL OREGON

by

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INTRODUCTION

Currently, landowners and managers in south-central Oregon are in the process of reevaluating their management objectives for lodgepole pine and second-growth ponderosa pine stands and they need some information pertaining to the recent losses occurring on their lands. They have also been inquiring if the mountain pine beetle is going to literally "explode" and what can they do to reduce or possibly prevent this event from occurring.

Dolph (1971) compiled and reported on mountain pine beetle activity in Oregon and Washington for the period between 1955 and 1966. The results of that analysis showed that 88 percent of lodgepole pine losses occurred in Oregon and 82 percent of that damage, 81.7 million board feet, occurred in south-central Oregon. For second-growth ponderosa pine, over 77 percent of losses occurred in Oregon and 27 percent of that damage took place in south-central Oregon, involving about 5 million board feet.

This report summarizes mountain pine beetle activity in lodgepole and second-growth ponderosa pine stands in south-central Oregon (see map) for the years between 1969 and 1980. In addition, a brief history of mountain pine beetle infestations, factors influencing epidemics, prediction for further damage, management alternatives to lessen the severity, or reduce the possibility of infestations are discussed.

Historic Patterns

Historically, mountain pine beetle has infested extensive areas of lodgepole pine and second-growth ponderosa pine stands and probably has been active in these ecosystems as long as there have been lodgepole and ponderosa pine trees.

The first recorded mountain pine beetle outbreak in south-central Oregon was in 1912[1/]. It occurred in the vicinity of Bald Mountain on the Silver Lake District, Fremont National Forest. An area of about 138,000 acres had been infested when the outbreak collapsed in 1914. In 1956, mountain pine beetle reappeared in the same general area and eventually encompassed the same six townships as reported in 1914. Beetle populations in the area peaked in 1969. During the 1970's the outbreak ebbed only to resurge again in 1980.

1/ Record on file in Portland, OR.

Similar outbreak patterns have occurred elsewhere in the lodgepole pine stands in south-central Oregon. Between 1925 and 1930, extensive tree killing occurred in Crater Lake National Park, around Diamond Lake on the Umpqua National Forest, and on Paulina Peak, Deschutes National Forest. In the late 1970's, the lodgepole pine stands in these three areas were again experiencing mountain pine beetle attacks. During the late 1940's a large beetle outbreak was detected on the Deschutes National Forest between Wanoga Butte and Swampy Lakes. This outbreak persisted until the late 1950's before collapsing. By the late 1970's the beetle returned and continued to kill trees in this area in 1980. Between 1965 and 1980, the beetle killed a significant number of lodgepole pine in the area surrounding Bear Wallows Butte just west of Bend, Oregon. In 1972 a beetle outbreak was reported in the vicinity of Crane Prairie Reservoir. By 1980, this outbreak had expanded to encompass most, if not all, of the lodgepole pine stands around Wickiup Reservoir and Davis Lake. For the Winema National Forest most of the mountain pine beetle activity has been restricted to the Chemult District. Since the early 1960's, tree killing has been observed almost annually in Cottonwood drainage, around Deer Butte, Walker Rim, and Pumice Butte.

It is a safe statement that there has never been a year when mountain pine beetle activity has not been observed somewhere in south-central Oregon since 1912.

Hosts

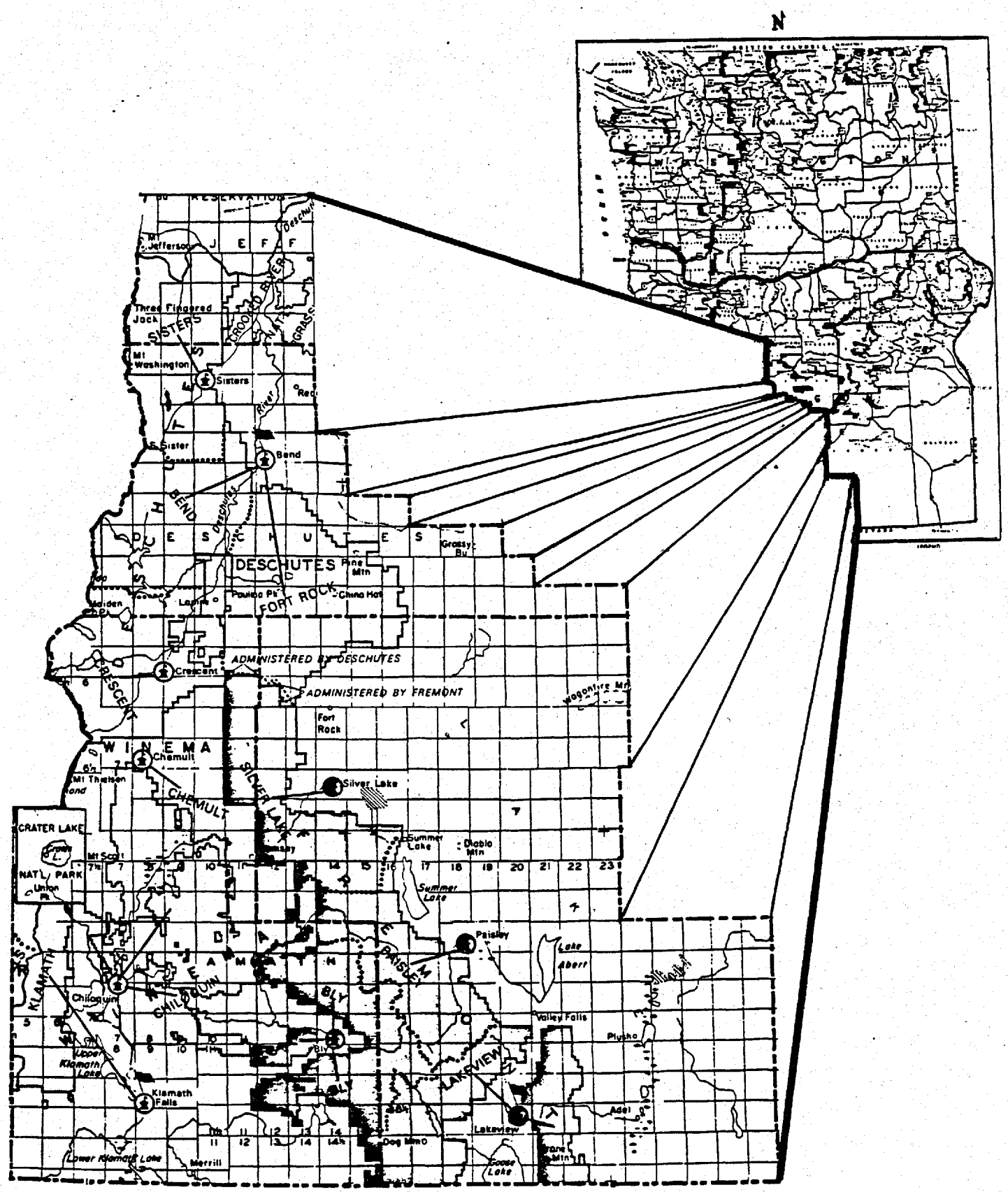
In south-central Oregon there is a total of 4,738,000 acres of commercial forest lands. The major tree species in this area are ponderosa pine and lodgepole pine. Berger (1968) reports lodgepole pine occupies approximately 1.4 million acres in Deschutes, Klamath, and Lake Counties, comprising south-central Oregon. The estimated board foot volume of ponderosa pine and lodgepole pine within these three counties are 20,315 MMBF and 3,865 MM, respectively.

Mountain pine beetle attacks and kills many species of pine within its host range. In south-central Oregon the species of pine attacked include ponderosa, lodgepole, sugar, western white, and white bark. When a mountain pine beetle infestation develops in a specific species of pine, the population tends to concentrate their attack to that species. However, other pine species present in or adjacent to infested stands may be attacked and killed. For example, infestations which develop in lodgepole pine stands are not expected to continue at epidemic levels in ponderosa, sugar, or western white pine stands. As infestations decline in lodgepole pine stands, mortality in the other pine species will likewise decrease. The percentage of mortality of the other species of pines will be less than that of lodgepole pine.

Lodgepole pine grows rapidly where competition is limited, reaching a size of about 80 feet in height and 16 inches d.b.h. in 50-60 years. Trees in unmanaged, even-aged stands in south-central Oregon average about 60 feet in height and 8 inches at age 100. However, lodgepole pine in this area is not mature until age 120, nor overmature until age 140.

Lodgepole pine in south-central Oregon is described as a climax species due to the pumice soils and the topographic features. Franklin and Dyreness (1973) report two types of lodgepole pine climax: (1) an edaphic climax on poorly drained soils, and (2) a topoedaphic climax in frost pocket depressions where the soil is often well drained.

Review *Area — Southcentral Oregon*



Mowat (1960) states the lodgepole pine cones in south-central Oregon are nonserotinous and seed fall occurs virtually every year. Regeneration is rapid and often dense once stands are opened up. Young trees grow rapidly but slow down as they reach maturity. The trees are highly susceptible to dwarf mistletoe infection and premature mortality from mountain pine beetle attack. Many of these characteristics contribute to large fuel buildups that lead to intense fires over wide areas, thus renewing the cycle.

The transition between lodgepole and ponderosa pine stands in south-central Oregon is often strikingly abrupt. This dramatic change is related to topography and climate. Ponderosa pine is found as elevation and precipitation increases above the depressions locally known as lodgepole flats. During the growing season, temperatures fluctuate widely from day to night. Frost may occur any night of the year, and cold air drains down over the lodgepole flats. Cochran and Berntsen (1973) found frost and frost-heaving has a great influence on the distribution of ponderosa pine since it is less tolerant than lodgepole pine.

Tree killing by mountain pine beetle in ponderosa pine is restricted primarily to second-growth rather than old-growth stands. The stands are usually even-aged, over-stocked, pole size (60-70 feet in height and 9 inches d.b.h.) and about 50 to 100 years old.

Factors Influencing Epidemics

The factors influencing mountain pine beetle epidemics differ according to the host. The primary factors associated with lodgepole pine stands in south-central Oregon have been stand age and average stand diameter. Stands more than 100 years old with the average stand diameter being larger than 8 inches d.b.h. have and will continue to suffer the greatest mortality. Stands between 60 and 100 years old are infested since there are sufficient number of large diameter (>8 inches dbh) trees susceptible to beetle attacks. Infestations, so far, have not developed in stands less than 60 years of age. This is partially due to trees being of small size. Trees younger than 60 years old may be infested, but when they are, there is only a slight danger that an outbreak will develop to epidemic status.

After measuring several lodgepole pine stands on the Deschutes National Forest, Waring, Pitman, and Mitchell[2/] have recently identified another factor which helps to explain why mountain pine beetles attack certain lodgepole pine trees and not others. They have found that trees producing more than 100 grams of wood per square meter of leaf surface are unlikely to be attacked. They report that only trees of low vigor are attacked and killed. Wood production can be estimated by measuring tree diameter and annual ring width and leaf area can be estimated from a linear relationship with tree sapwood area.

The factors influencing mountain pine beetle epidemics in second-growth ponderosa pine stands have been identified by Sartwell and Stevens (1975). The factors include: (1) pure or nearly pure stands; (2) essentially even-aged; (3) stands 50 to 100 years old; (4) tree diameter, 8-12 inch d.b.h.; and (5) stem basal area generally in excess of 150 square feet per acre.

2/ Personal communication on 27 January 1981. R. H. Waring is a professor and G. B. Pitman is an associate professor, Dept. of Forest Science, School of Forestry, Oregon State University and R. G. Mitchell, Research Entomologist, U.S. Forest Service, Bend Silvicultural Laboratory, Bend, Oregon.

The risk of lodgepole and second-growth ponderosa pine stands to mountain pine beetle can be determined by applying the factors discussed above.

Prediction

Trend predictions are not precise, even though research and evaluations have been occurring for a long time. Projections of mortality are based on the professional judgment of specialists who rely on extensive written data and their own experience and knowledge of the beetle-forest interaction.

Safranyik et al (1974), doing mountain pine beetle research in British Columbia, has identified six criteria for determining the likelihood of beetle immigration into an uninfested area:

1. Historic evidence of beetle activity in surrounding areas.
2. Recent beetle activity, particularly within the past 3-5 years. Determination of building or declining populations.
3. Tree age, size, and species distribution within the uninfested area. Are trees of a susceptible age and size class and does the stand have a high percentage of host species?
4. Large contiguous areas of high-hazard, uninfested trees.
5. Major outbreaks near the uninfested area. There is much evidence to show that beetle populations do migrate into, as well as develop in, a given stand.
6. Relationship of elevation and latitude.

Many of these same criteria have been outlined by Amman et al (1977). Their criteria for a high-hazard lodgepole stand are:

1. Average stand age: >80 years.
2. Average stand diameter: >8 inches.
3. Elevation: $<8{,}000$ feet (at 42° N latitude).

After measuring several lodgepole pine stands in Colorado, Cole and Cahill (1976) stated that epidemics are not as likely to occur in stands where less than 20 percent of the trees are more than 8 inches d.b.h. and contain phloem 0.11 inch thick or thicker. They concluded that the distribution of phloem thickness over tree diameter classes can be an effective measurement for evaluating infestation potential in a lodgepole pine stand.

Based on the parameters of the current infestation and knowing that much of the 1.4 million acres of lodgepole pine in south-central Oregon meet the high-risk category, there is a high probability of having a much more serious beetle infestation. How long it will take before catastrophic losses occur is not known, but it will probably occur within the next 20 years. With that knowledge, harvest schedules should include removing most of the high-hazard stands within the same 20-year period. Removing high-hazard stands will help reduce beetle pressure and subsequent tree mortality in stands rated moderate or low hazard. In addition, the removal of beetle-infested trees will help reduce the threat to the other pine species growing in the immediate vicinity.

Management Strategies

Lodgepole Pine

The management of lodgepole pine and the mountain pine beetle problem require two separate courses of action. First, we must consider managing stands where the mountain pine beetle is already present. The second is to hazard rate the remaining lodgepole pine stands and establish a harvesting schedule designed to remove the high risk stands in an orderly fashion before they are attacked by the beetle.

Within the past several years, much valuable information has been obtained concerning manipulation of mountain pine beetle populations through appropriate stand management. D. M. Cole (1977) and Amman et al (1977) have stated that infested stands and high-risk stands can be managed in several ways, depending upon land use objectives and stand composition.

Depending on the long-term timber management objectives, one viable alternative is to discriminate against lodgepole pine and convert the site to some other tree species. However, if the timber management objectives include maintaining lodgepole pine as a component, then certain silvicultural treatments are needed to help eliminate those stands which are susceptible to large buildups of beetle populations.

Where extensive, pure, even-aged lodgepole pine stands with large diameter and older age trees (high-risk) are present, management practices should establish new stands that are more diversified in age and size classes. By creating a mosaic of age and size classes, it will help prevent the development of simultaneous outbreaks over large areas. To accomplish this, Berntsen (1975) recommends clearcutting. Well organized small clearcut blocks are one of the best means to convert mature and overmature stands to younger age classes because it simulates the natural disturbance that create conditions favorable for lodgepole pine establishment.

Even-aged lodgepole pine stands can also be regenerated, by either a shelterwood or seed tree cutting method. Alexander (1954 and 1975) and Lotan (1975) cautioned that partially open lodgepole pine stands may be more susceptible to windthrow, dwarf mistletoe, and logging damage.

There is some evidence to indicate that thinning may help reduce and possibly prevent mountain pine beetle activity in high-risk stands. Waring and Pitman (1980) have developed a technique for rating the vigor of individual trees. They report trees with a vigor index above 8 percent (basal area of current increment/sapwood basal area) were not killed and trees with vigor indexes below 8 percent were killed. Their results also indicate trees with a high vigor index will respond to release regardless of age.

Recognizing that many campgrounds, picnic areas, and other developed sites are often situated in mature and overmature lodgepole pine stands with high risk trees (large diameters and older age), preparations should be made to start converting these stands to younger age classes before the beetle becomes active and reduces the number of silvicultural options available for

the conversion. Generally, a combination of small patch cuts and a variety of partial cuts of different intensities can be applied for establishing a new stand on the site (Holm and Eccles, 1980).

Where individual trees have high value, such as around administrative and home sites and in campgrounds, the trees can be protected from mountain pine beetle attack through the use of preventative sprays. An application of Sevimol-4^{R}, a water-soluble mixture of carbaryl insecticide in a molasses carrier prior to beetle flight has proven to be a safe and efficient means of protecting individual trees (Gibson 1978).

Technology is available for risk rating lodgepole pine stands most susceptible to mountain pine beetle damage. To prevent and reduce the risk of future beetle losses, land managers must adopt these techniques and apply appropriate silvicultural treatments in accordance with land use objectives and stand composition.

For long-term planning, the risk-rating system land managers can use is the system devised by Amman et al (1977). This method provides data for classifying lodgepole pine stands into broad categories of either high-, moderate-, or low-risk. The factors necessary for hazard rating stands are average stand diameter, average stand age, elevation, and latitude; factors usually obtained during stand exams.

A set of risk factors (1 = low; 2 = moderate; 3 = high) is assigned for elevation and latitude, average age, and average dbh, as shown below:

Elevation Latitude	Average age (Years)	Average dbh (Inches)
High (1)	60 (1)	7 (1)
Moderate (2)	60-80 (2)	7-8 (2)
Low (3)	80 (3)	8 (3)

By multiplying the risk factors, the stand's classification is obtained; low = 1 to 9; moderate = 12 to 18; high = 27.

Since most of the lodgepole pine stands in south-central Oregon occur below 6,500 feet between 42° and 45° latitude, foresters need only to collect the average age and diameter of the stands in order to use the risk factors identified above.

The first priority in hazard rating should be lodgepole pine stands in areas where timber values are primary (commercial forest lands) and areas where individual trees have high value (commercial forest lands but the harvest is classified as unregulated as in campgrounds and picnic areas). For areas where nontimber values are primary (wilderness and other dedicated sites), stands can be hazard rated at a later date since beetle activity and tree killing in the stand are generally interpreted to be a part of the natural ecological process in stand succession and the recommended treatment policy is "do nothing."

Ponderosa Pine

The management of second-growth ponderosa pine and the mountain pine beetle follows closely the same concepts discussed for lodgepole pine. First, consider managing the stands where the beetle is present. Secondly, hazard rate the remaining second-growth ponderosa pine stands and establish a thinning schedule to reduce the threat of the beetles attacking the stand.

Sartwell and Stevens (1975) have stated that silvicultural treatments deserve major emphasis in action programs against the mountain pine beetle in second-growth stands of ponderosa pine. Sartwell and Dolph (1976) found that thinning overstocked stands will control mountain pine beetle outbreaks. Barrett (1979) lists as the recommended treatment thinning to a density well below the maximum stocking level curve, such as 70 to 80 sq. ft. of basal area per acre. This should "bug proof" the stand until the first commercial entry is made. Preferably stands should be thinned well before any beetle activity is evident.

Second-growth ponderosa pine stands can be risk-rated for potential mountain pine beetle activity by measuring stand age, tree size, and stand density, factors usually obtained during stand exams. In south-central Oregon where much of the ponderosa pine land rates as site class III or IV (site index 71-98), stands usually sustain their first serious infestations between ages 50 and 75 years, trees average 8 inches d.b.h. and larger, and stand density exceeds 150 square feet per acre.

From the hazard rating process, the first thinning priority should be all second-growth ponderosa pine stands in areas where timber values are primary (commercial forest lands). Sassaman et al (1977) presented some guides to further help land managers to identify their most financially attractive precommercial thinning opportunities.

PROCEDURES

Most forest insect outbreaks are detected from the air during annual aerial survey. For bark beetles, the damage is sketched on maps and the number of "red-top" trees are recorded. The results are presented in tabular format listing the number of infestation centers, acres damaged, number of dead trees, and the estimated volume. The data is displayed by National Forests, Ranger Districts, Wilderness Areas, and non-Forest Service which includes State, private, and Bureau of Land Management lands. The maps used on the survey do not identify BLM lands from the other ownerships.

Mountain pine beetle losses in this report are presented according to the host affected. The format to display the data is to separate the 12-year period into two 6-year increments. The first 6-year increment is the total damage for the years 1969 through 1974. Starting with 1975, the damage is shown for each year to illustrate the yearly fluctuation.

RESULTS

Tables displaying mountain pine beetle activity and losses in lodgepole and ponderosa pine follow. The reader is cautioned when reviewing the total number of infested acres because it is a cumulative total; any acre could have been tallied for each year during the 12-year period. It generally takes 10 to 15 years or longer before most of the larger diameter trees on an acre are killed. Acreage figures listed for each year, however, are accurate since they denote the area of actual tree mortality.

The loss to mountain pine beetle in lodgepole pine stands in south-central Oregon between 1969 and 1980 was approximately 314 million board feet. In second-growth ponderosa pine, the estimated loss was 12.7 million board feet.

In lodgepole pine stands, there was an annual increase factor of 6.6 in the number of trees killed between 1978 and 1980. In the second-growth ponderosa pine, tree killing has been relatively low and static.

When comparing mountain pine beetle losses tabulated for 1969-1980 with losses compiled between 1955 and 1966, there has been a significant increase in tree mortality during the period between 1969 and 1980.

Mountain Pine Beetle in Lodgepole Pine Stands
in Deschutes Plateau and Klamath Basin Areas
1969 thru 1980

Losses for All Ownerships by Forest Area	No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
DESCHUTES				
1969-1974	603	167,410	673,603	47,152.21
1975	90	49,010	93,115	6,518.05
1976	65	50,340	112,205	7,854.35
1977	143	52,030	70,011	4,900.77
1978	270	56,350	47,817	3,347.19
1979	490	133,790	208,121	14,568.47
1980	325	300,370	405,201	28,364.07
Total	1,986	809,300	1,610,073	112,705.11
FREMONT				
1969-1974	623	343,060	1,323,780	92,664.60
1975	97	95,720	249,219	17,445.33
1976	120	74,410	312,171	21,851.97
1977	76	28,350	40,171	2,811.97
1978	128	32,460	25,152	1,760.64
1979	217	70,610	90,933	6,365.31
1980	145	59,530	147,325	10,312.75
Total	1,406	704,140	2,188,751	153,212.57
WINEMA				
1969-1974	519	166,620	422,041	29,542.87
1975	67	27,940	55,459	3,882.13
1976	146	21,300	20,955	1,466.85
1977	74	18,300	17,094	1,196.58
1978	166	26,990	25,920	1,814.40
1979	237	58,490	41,861	2,930.27
1980	271	57,550	103,169	7,221.83
Total	1,480	377,190	686,499	48,054.93
Grand Total	4,872	1,890,630	4,485,323	313,972.61

1/ Volume estimate based on average 70 bd.ft. per tree

Mountain Pine Beetle in Lodgepole Pine Stands
in Deschutes Plateau and Klamath Basin Areas
1969 thru 1980

Losses by Area, Land Use and Ownership	No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
DESCHUTES AREA				
For.Serv. Commercial	1,675	746,250	1,512,266	105,858.62
Wilderness	36	10,960	31,437	2,200.59
FS Total	1,711	757,210	1,543,703	108,059.21
State/Private/BLM	275	52,090	66,370	4,645.90
Total	1,986	809,300	1,610,073	112,705.11
FREMONT AREA				
For.Serv. Commercial	936	540,390	1,767,779	123,744.53
Wilderness	65	24,570	65,403	4,578.21
FS Total	1,001	564,960	1,833,182	128,322.74
State/Private/BLM	405	139,180	355,569	24,889.83
Total	1,406	704,140	2,188,751	153,212.57
WINEMA AREA				
For.Serv. Commercial	1,077	301,490	580,134	40,609.38
Wilderness	41	18,830	43,783	3,064.81
FS Total	1,118	320,320	623,917	43,674.19
State/Private/BLM	362	55,870	62,582	4,380.74
Total	1,480	376,190	686,499	48,054.93
ENTIRE AREA				
For.Serv. Commercial	3,688	1,588,130	3,860,179	270,212.53
Wilderness	142	54,360	140,623	9,843.61
FS Total	3,830	1,642,490	4,000,802	280,056.14
State/Private/BLM	1,042	247,140	484,521	33,916.47
GRAND TOTAL	4,872	1,889,630	4,485,323	313,972.61

1/ Volume estimate based on average 70 bd. ft. per tree.

Mountain Pine Beetle in Lodgepole Pine Stands
in Deschutes Plateau and Klamath Basin Areas
by 6-Year Increments for 1969-1974 and 1975-1980

Losses for All Ownerships by Area/Forest	No. of Centers	Acres	No. of trees	Volume (MBF)
DESCHUTES				
1969 - 1974	603	167,410	673,603	47,152.21
1975 - 1980	1,383	641,890	936,470	65,552.90
Total	1,986	809,300	1,610,073	112,705.11
FREMONT				
1969 - 1974	623	343,060	1,323,780	92,664.60
1975 - 1980	783	361,080	864,971	60,547.97
Total	1,406	704,140	2,188,751	153,212.57
WINEMA				
1969 - 1974	519	166,620	422,041	29,542.87
1975 - 1980	961	210,570	264,458	18,512.06
Total	1,480	377,190	686,499	48,054.93
ENTIRE AREA				
1969 - 1974	1,745	677,090	2,419,424	169,359.68
1975 - 1980	3,127	1,213,540	2,065,899	144,612.93
Total	4,872	1,890,630	4,485,323	313,972.61

Mountain Pine Beetle in Lodgepole Pine
in the Deschutes National Forest Area
1969 thru 1980

District		No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
Bend	1969-1974	168	59,430	273,528	19,146.96
	1975	11	14,130	30,475	2,133.25
	1976	21	23,800	54,345	3,804.15
	1977	34	14,470	23,779	1,664.53
	1978	45	20,260	25,212	1,764.84
	1979	97	34,700	66,570	4,659.90
	1980	77	82,420	155,866	10,910.62
Total		453	249,210	629,775	44,084.25
Crescent	1969-1974	163	28,680	32,367	2,265.69
	1975	20	4,210	6,885	481.95
	1976	9	5,270	6,735	471.45
	1977	18	3,590	5,330	373.10
	1978	45	7,540	4,465	312.55
	1979	96	18,660	20,468	1,432.76
	1980	92	61,590	68,844	4,819.08
Total		443	129,540	145,094	10,156.58
Fort Rock	1969-1974	136	29,100	93,307	6,531.49
	1975	39	12,860	9,680	677.60
	1976	27	15,850	49,015	3,431.05
	1977	59	25,960	32,858	2,300.06
	1978	89	15,530	9,815	687.05
	1979	173	66,030	112,654	7,885.78
	1980	71	129,610	159,392	11,157.44
Total		594	294,940	466,721	32,670.47
Sisters	1969-1974	58	37,020	225,785	15,804.95
	1975	7	11,090	27,190	1,903.30
	1976	4	4,950	1,970	137.90
	1977	14	5,390	6,160	431.20
	1978	55	8,940	6,940	485.80
	1979	25	3,290	1,651	115.57
	1980	22	1,880	980	68.60
Total		185	72,560	270,676	18,947.32
GRAND TOTAL		1,675	746,250	1,512,266	105,858.62

1/ Volume estimate based on average 70 bd.ft. per tree.

Mountain Pine Beetle in Lodgepole Pine
in the Deschutes National Forest Area
1969 thru 1980

District - Wilderness Areas		No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
Diamond Pk.	1969-1974	2	490	320	22.40
	1975	1	340	500	35.00
	1978	1	100	30	2.10
	1979	2	130	30	2.10
Total		6	1,060	880	61.60
Jefferson	1969-1974	4	530	2,135	149.45
	1975	2	1,040	800	56.00
	1977	9	1,310	942	65.94
	1980	3	1,390	1,080	75.60
Total		18	4,270	4,957	346.99
Washington	1969-1974	1	100	200	14.00
	1975-1980	0	0	0	0
Total		1	100	200	14.00
Three Sisters	1969-1974	2	190	8,020	561.40
	1975	6	5,100	17,340	1,213.80
	1976	1	150	30	2.10
	1978	1	40	5	0.35
	1979	1	50	5	0.35
Total		11	5,530	25,400	1,778.00
GRAND TOTAL		36	10,960	31,437	2,200.59

1/ Volume estimate based on average 70 bd. ft. per tree.

Mountain Pine Beetle in Lodgepole Pine
in the Deschutes National Forest Area
1969 thru 1980

District	No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
State/Private/BLM*				
1969-1974	69	11,870	37,941	2,655.87
1975	4	240	245	17.15
1976	3	320	110	7.70
1977	9	1,310	942	65.94
1978	34	3,940	1,350	94.50
1979	96	10,930	6,743	472.01
1980	60	23,480	19,039	1,332.73
Total	275	52,090	66,370	4,645.90
Deschutes Area Total for all Ownerships				
1969-1974	603	167,410	673,603	47,152.21
1975	90	49,010	93,115	6,518.05
1976	65	50,340	112,205	7,854.35
1977	143	52,030	70,011	4,900.77
1978	270	56,350	47,817	3,347.19
1979	490	133,790	208,121	14,568.47
1980	325	300,370	405,201	28,364,07
GRAND TOTAL	1,986	809,300	1,610,073	112,705.11
(BLM losses - data included above) 1978	6	700	190	13.30
1979	20	3,400	1,985	138.95
1980	14	7,580	6,001	420.07
Total	40	11,680	8,176	572.32

*Data program did not separate losses on BLM lands until 1978, the total shown includes BLM losses from 1969 through 1980.

1/ Volume estimate based on average 70 bd. ft. per tree.

Mountain Pine Beetle Losses in Lodgepole Pine Stands in the Deschutes National Forest Area by 6-Year Increments--1969-1974 and 1975-1980

		No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
Bend	1969-1974	168	59,430	273,528	19,146.96
	1975-1980	285	189,780	356,247	24,937.29
Total		453	249,210	629,775	44,084.25
Crescent	1969-1974	163	28,680	32,367	2,265.69
	1975-1980	280	100,860	112,727	7,890.89
Total		443	129,540	145,094	10,156.58
Ft. Rock	1969-1974	136	29,100	93,307	6,531.49
	1975-1980	458	265,840	373,414	26,138.96
Total		594	294,940	466,721	32,670.45
Sisters	1969-1974	58	37,020	225,785	15,804.95
	1975-1980	127	35,540	44,891	3,142.37
Total		185	72,560	270,676	18,947.32
Wilderness	1969-1974	9	1,310	10,675	747.25
	1975-1980	27	9,650	20,762	1,453.34
Total		36	10,960	31,437	2,200.59
S&PF/BLM	1969-1974	69	11,870	37,941	2,655.87
	1975-1980	206	40,220	28,429	1,990.03
Total		275	52,090	66,370	4,645.90
All	1969-1974	603	167,410	673,603	47,152.21
	1975-1980	1,383	641,890	936,470	65,552.88
GRAND TOTAL		1,986	809,300	1,610,073	112,705.09

1/ Volume estimate based on average 70 bd. ft. per tree.

Mountain Pine Beetle Losses in Lodgepole Pine
in the Fremont National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
Bly	1969-1974	51	13,000	52,807	3,696.49
	1975	5	2,240	5,300	371.00
	1976	20	6,600	10,643	745.01
	1977	1	210	30	2.10
	1978	10	650	575	40.25
	1979	25	1,780	1,320	92.40
	1980	20	4,540	5,064	358.48
Total		132	29,020	75,739	5,305.73
Lakeview	1969-1974	38	14,430	26,675	1,867.25
	1975	14	6,520	26,645	1,865.15
	1976	17	8,120	18,546	1,298.22
	1977	11	2,070	3,240	226.80
	1978	5	500	310	21.70
	1979	1	40	10	0.70
	1980	17	720	725	50.75
Total		103	32,400	76,151	5,330.57
Silver Lk.	1969-1974	178	163,980	774,856	54,239.92
	1975	25	33,840	75,142	5,259.94
	1976	23	28,580	160,015	11,201.05
	1977	25	17,460	22,105	1,547.35
	1978	55	19,960	15,059	1,054.13
	1979	84	48,990	67,639	4,734.73
	1980	39	38,380	116,005	8,120.35
Total		429	351,190	1,230,821	86,157.47
Paisley	1969-1974	157	69,270	220,550	15,438.50
	1975	18	32,390	90,820	6,357.40
	1976	25	19,260	70,548	4,938.36
	1977	10	1,590	206	14.42
	1978	17	1,130	560	39.20
	1979	32	1,640	1,050	73.50
	1980	13	2,500	1,334	93.38
Total		272	127,780	385,068	26,954.76
GRAND TOTAL		936	540,390	1,767,779	123,748.53

1/ Volume estimate based on average 70 bd. ft. per tree.

Mountain Pine Beetle Losses in Lodgepole Pine
in the Fremont National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Gearhart Mtn.					
Wilderness	1969-1974	40	13,490	24,700	1,729.00
	1975	4	5,230	19,800	1,386.00
	1976	7	4,140	18,203	1,274.21
	1977	2	1,250	2,115	148.05
	1978	5	260	85	5.95
	1979	7	200	500	35.00
	1980	0	0	0	0
Total		65	24,570	65,403	4,578.21
State/Pvt/BLM					
	1969-1974	159	68,890	224,192	15,693.44
	1975	31	15,500	31,512	2,205.84
	1976	28	7,710	34,216	2,395.12
	1977	27	5,770	12,475	873.25
	1978	36	9,960	8,563	599.41
	1979	68	17,960	20,414	1,428.98
	1980	56	13,390	24,197	1,693.79
Total		405	139,180	355,569	24,889.83
Fremont Area Total All Ownerships					
	1969-1974	623	343,060	1,323,780	92,664.60
	1975	97	95,720	249,219	17,445.33
	1976	120	74,410	312,171	21,851.97
	1977	76	28,350	40,171	2,811.97
	1978	128	32,460	25,152	1,760.64
	1979	217	70,610	90,933	6,365.31
	1980	145	59,530	147,325	10,312.75
GRAND TOTAL		1,406	704,140	2,188,751	153,212.57

Mountain Pine Beetle Losses in Lodgepole Pine in the Fremont National Forest Area by 6-Year Increments--1969-1974 and 1975-1980

		No. of Centers	Acres	No. of trees	Volume (MBF)
Bly	1969-1974	51	13,000	52,807	3,696.49
	1975-1980	81	16,020	22,932	1,605.24
Total		132	29,020	75,739	5,301.73
Lakeview	1969-1974	38	14,430	26,675	1,867.25
	1975-1980	65	17,970	49,476	3,463.32
Total		103	32,400	76,151	5,330.57
Silver Lk.	1969-1974	178	163,980	774,856	54,239.92
	1975-1980	251	187,210	455,965	31,917.55
Total		429	351,190	1,230,821	86,157.47
Paisley	1969-1974	157	69,270	220,550	15,438.50
	1975-1980	115	58,510	164,518	11,516.26
Total		272	127,780	385,068	26,954.76
Wilderness	1969-1974	40	13,490	24,700	1,729.00
	1975-1980	25	11,080	40,703	2,849.21
Total		65	24,570	65,403	4,578.21
State/Pvt/BLM					
	1969-1974	159	68,890	224,192	15,693.44
	1975-1980	246	70,290	131,377	9,196.39
Total		405	139,180	355,569	24,889.83
All	1969-1974	623	343,060	1,323,780	92,664.60
	1975-1980	783	361,080	864,971	60,547.97
Total		1,406	704,140	2,188,751	153,212.57

Mountain Pine Beetle Losses in Lodgepole Pine
in the Winema National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Chemult	1969-1974	262	106,780	311,377	21,796.39
	1975	35	17,970	21,305	1,491.35
	1976	93	9,460	6,335	443.45
	1977	41	12,420	9,928	694.96
	1978	83	16,370	15,795	1,105.65
	1979	133	47,780	34,456	2,411.92
	1980	153	39,220	84,585	5,920.95
Total		800	250,000	483,781	33,864.67
Chiloquin	1969-1974	47	9,340	6,084	425.88
	1975	9	1,730	13,424	939.68
	1976	1	100	30	2.10
	1977	3	150	40	2.80
	1978	24	1,340	885	61.95
	1979	35	1,250	1,160	81.20
	1980	23	2,530	1,655	115.85
Total		142	16,440	23,278	1,629.46
Klamath	1969-1974	74	18,210	33,945	2,376.15
	1975	11	5,070	16,520	1,156.40
	1976	15	4,260	4,940	345.80
	1977	7	2,780	6,495	454.65
	1978	7	2,280	4,660	326.20
	1979	8	1,580	1,960	137.20
	1980	13	1,870	4,555	318.85
Total		135	36,050	73,075	5,115.25
SUBTOTAL		1,077	302,490	580,134	40,609.38
Mtn. Lakes Wilderness					
	1969-1974	20	10,140	36,140	2,529.80
	1975	3	1,960	2,050	143.50
	1976	4	2,250	2,730	191.10
	1977	0	0	0	0
	1978	5	1,750	1,690	118.30
	1979	2	1,270	468	32.76
	1980	7	1,460	705	49.35
Total		41	18,830	43,783	3,064.81

Mountain Pine Beetle in Lodgepole Pine
in the Winema National Forest Area
1969 through 1980

District	No. of Centers	Acres	No. of trees	Volume (MBF)
State/Private/BLM				
1969-1974	116	22,150	34,495	2,414.65
1975	9	1,210	2,160	151.20
1976	33	5,230	6,920	484.40
1977	23	2,950	631	44.17
1978	47	5,250	2,890	202.30
1979	59	6,610	3,817	267.19
1980	75	12,470	11,669	816.83
Total	362	55,870	62,582	4,380.74
All Ownerships				
1969-1974	519	166,620	422,041	29,542.87
1975	67	27,940	55,459	3,882.13
1976	146	21,300	20,955	1,466.85
1977	74	18,300	17,094	1,196.58
1978	166	26,990	25,920	1,814.40
1979	237	58,490	41,861	2,930.27
1980	271	57,550	103,169	7,221.83
Total	1,480	377,190	686,499	48,054.93

Mountain Pine Beetle in Lodgepole in Crater Lake Nat. Park
1969 through 1980

1969-1974	77	29,170	86,483	6,053.81
1975	2	780	350	24.50
1976	6	1,550	220	15.40
1977	6	120	50	3.50
1978	10	1,210	815	57.05
1979	15	3,570	2,738	191.90
1980	12	4,510	7,280	509.70
Total	128	40,910	97,936	6,855.86
1969-1974	77	29,170	86,483	6,053.81
1975-1980	51	11,740	11,453	802.05

Mountain Pine Beetle Losses in Lodgepole Pine in the Winema National Forest Area by 6-Year Increments--1969-1974 and 1975-1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Chemult	1969-1974	262	106,780	311,377	21,796.39
	1975-1980	538	143,220	172,404	12,068.26
Total		800	250,000	483,781	33,864.65
Chiloquin	1969-1974	47	9,340	6,084	425.88
	1975-1980	95	7,100	17,194	1,203.58
Total		142	16,440	23,278	1,629.46
Klamath	1969-1974	74	18,210	33,945	2,376.15
	1975-1980	61	16,840	39,130	2,739.10
Total		135	35,050	73,075	5,115.25
Wilderness	1969-1974	20	10,140	36,140	2,529.80
	1975-1980	21	8,690	7,643	535.01
Total		41	18,830	43,783	3,064.81
State/Private/BLM					
	1969-1974	116	22,150	34,495	2,414.65
	1975-1980	246	33,720	28,087	1,966.09
Total		362	55,870	62,582	4,380.74
All	1969-1974	519	166,620	422,041	29,542.87
	1975-1980	961	210,570	264,458	18,512.04
Total		1,480	377,190	686,499	48,054.91

PONDEROSA PINE

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in Deschutes Plateau and Klamath Basin Areas
1969 thru 1980

Losses for All Ownerships by Forest Area	No. of Centers	Acres	No. of trees	Volume (MBF)
DESCHUTES				
1969-1974	136	23,420	46,977	3,758.16
1975	3	40	18	1.44
1976	5	520	65	5.20
1977	10	620	205	16.40
1978	26	1,310	760	60.80
1979	46	5,400	1,268	101.40
1980	56	10,480	3,510	280.80
Total	282	41,790	52,803	4,224.20
FREMONT				
1969-1974	255	29,690	32,241	2,579.28
1975	30	4,040	2,914	233.12
1976	40	13,530	9,728	778.24
1977	99	11,260	2,269	181.52
1978	92	10,450	2,320	185.60
1979	345	29,440	17,498	1,399.84
1980	108	8,860	10,968	877.44
Total	969	107,270	77,938	6,235.04
WINEMA				
1969-1974	110	13,090	14,891	1,191.28
1975	10	260	165	13.20
1976	13	3,150	2,065	165.20
1977	28	2,730	403	32.24
1978	35	7,720	4,366	349.28
1979	98	5,750	3,197	255.76
1980	79	8,190	3,004	240.32
Total	373	40,890	28,091	2,247.28
GRAND TOTAL	1,624	189,950	158,832	12,706.52

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in Deschutes Plateau and Klamath Basin Areas
1969 thru 1980

Losses by Land Use, Ownership in Each Area	No. of Centers	Acres	No. of trees	Volume (MBF)
DESCHUTES AREA				
FS Commercial	262	39,390	52,013	4,161.04
Wilderness	1	100	8	0.64
FS Total	263	39,490	52,021	4,161.68
State/Private/BLM	19	2,300	782	62.52
Grand Total	282	41,790	52,803	4,224.20
FREMONT AREA				
FS Commercial	651	75,520	59,856	4,788.48
Wilderness	2	90	60	4.80
FS Total	653	75,610	59,916	4,793.28
State/Private/BLM	316	31,660	18,022	1,441.76
Grand Total	969	107,270	77,938	6,235.04
WINEMA AREA				
FS Commercial	167	16,870	15,631	1,250.48
Wilderness	3	80	36	2.88
FS Total	170	16,950	15,667	1,253.36
State/Private/BLM	203	23,940	12,424	993.92
Grand Total	373	40,890	28,091	2,247.28
ENTIRE AREA				
FS Commercial	1,080	131,780	127,500	10,200.00
Wilderness	6	270	104	8.32
FS Total	1,086	132,050	127,604	10,208.32
State/Private/BLM	538	57,900	31,228	2,498.20
GRAND TOTAL	1,624	189,950	158,832	12,706.52

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in Deschutes Plateau and Klamath Basin Areas
by 6-Year Increments for 1969-1974 and 1975-1980

Losses for All Ownerships by Area/Forest	No. of Centers	Acres	No. of trees	Volume (MBF)
DESCHUTES				
1969 - 1974	136	23,420	46,977	3,758.16
1975 - 1980	146	18,370	5,826	466.04
Total	282	41,790	52,803	4,224.20
FREMONT				
1969 - 1974	255	29,690	32,241	2,579.28
1975 - 1980	714	77,580	45,697	3,655.76
Total	969	107,270	77,938	6,235.04
WINEMA				
1969 - 1974	110	13,090	14,891	1,191.28
1975 - 1980	263	27,800	13,200	1,056.00
Total	373	40,890	28,091	2,247.28
ENTIRE AREA				
1969 - 1974	501	66,200	94,109	7,528.72
1975 - 1980	1,123	123,750	64,723	5,177.80
Total	1,624	189,950	158,832	12,706.52

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Deschutes National Forest Area
1969 thru 1980

District		No. of Centers	Acres	No. of trees	Volume[1/] (MBF)
Bend	1969-1974	35	12,350	32,448	2,595.84
	1978[2/]	2	90	170	13.60
	1979	6	330	85	6.80
	1980	12	3,040	840	67.20
Total		55	15,810	33,543	2,683.44
Crescent	1969-1974	18	2,680	5,033	402.64
	1976	1	90	10	0.80
	1977	1	20	5	0.40
	1979	13	950	285	22.80
	1980	9	1,000	190	15.20
Total		42	4,740	5,523	441.84
Fort Rock	1969-1974	19	920	848	67.84
	1977	5	180	100	8.00
	1978	11	320	110	8.80
	1979	10	610	200	16.00
	1980	7	4,190	1,615	129.20
Total		52	6,220	2,873	229.84
Sisters	1969-1974	56	6,930	8,281	662.48
	1975	3	40	18	1.44
	1976	3	410	50	4.00
	1977	2	160	60	4.80
	1978	13	900	480	38.40
	1979	13	2,250	375	30.00
	1980	23	1,930	810	64.80
Total		113	12,620	10,074	805.92
Subtotal FS Comm. Land		262	39,390	52,013	4,161.04
Diamond Pk. Wilderness					
	1969-1974	1	100	8	0.64
	1975-1980	0	0	0	0.00
Total		1	100	8	0.64
Losses by 6-Year Increments for all Ownerships: 1969-1974 and 1975-1980					
	1969-1974	136	23,420	46,977	3,758.16
	1975-1980	146	18,370	5,826	466.04
GRAND TOTAL		282	41,790	52,803	4,224.20

1/ Based on average tree volume of 80 bd. ft. per tree.
2/ Years with damage are shown only.

District	No. of Centers	Acres	No. of trees	Volume (MBF)
State/Private/BLM				
1969-1974	7	440	359	28.72
1976	1	20	5	0.40
1977	2	260	40	3.20
1979	4	1,260	323	25.80
1980	5	320	55	4.40
Total	19	2,300	782	62.52
Area Total				
1969-1974	136	23,420	46,977	3,758.16
1975	3	40	18	1.44
1976	5	520	65	5.20
1977	10	620	205	16.40
1978	26	1,310	760	60.80
1979	46	5,400	1,268	101.40
1980	56	10,480	3,510	280.80
GRAND TOTAL	282	41,790	52,803	4,224.20
LOSS BY LAND USE AND OWNERSHIP FROM 1969 THROUGH 1980				
FS Commercial	262	39,390	52,013	4,161.04
Wilderness	1	100	8	0.64
State/Private/BLM	19	2,300	782	62.52
Total	282	41,790	52,803	4,224.20
LOSS BY 6-YEAR INCREMENTS--1969-1974 AND 1975-1980				
FS Comm. 1969-1974	128	22,880	46,610	3,728.80
1975-1980	134	16,510	5,403	432.24
Total	262	39,390	52,013	4,161.04
FS Wilderness				
1969-1974	1	100	8	0.64
1975-1980	0	0	0	0
Total	1	100	8	0.64
State/Private/BLM				
1969-1974	7	440	359	28.72
1975-1980	12	1,860	423	33.80
Total	19	2,300	782	62.52
GRAND TOTAL	282	41,790	52,803	4,224.20

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Fremont National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Bly	1969-1974	23	2,330	3,041	243.28
	1975	1	40	10	0.80
	1976	8	3,320	2,155	172.40
	1977	11	990	225	18.00
	1978	13	760	380	30.40
	1979	61	3,900	2,395	191.60
	1980	15	810	460	36.80
Total		132	12,150	8,666	693.28
Lakeview	1969-1974	71	9,470	7,641	611.28
	1975	11	1,100	121	9.68
	1976	14	4,000	360	28.80
	1977	34	4,530	541	43.28
	1978	40	5,870	950	76.00
	1979	127	9,040	5,835	466.80
	1980	26	3,450	2,900	232.00
Total		323	37,460	18,348	1,467.84
Paisley	1969-1974	42	5,500	4,939	395.12
	1975	3	610	60	4.80
	1976	3	2,240	6,375	510.00
	1977	9	750	90	7.20
	1978	4	340	85	6.80
	1979	48	7,080	3,680	294.40
	1980	24	2,320	5,453	436.24
Total		133	18,840	20,682	1,654.56
Silver Lake	1969-1974	21	2,530	8,475	678.00
	1975	5	730	2,050	164.00
	1976	4	1,010	100	8.00
	1977	4	340	120	9.60
	1978	5	410	225	18.00
	1979	20	1,970	1,125	90.00
	1980	4	80	65	5.20
Total		63	7,070	12,160	972.80
COMMERCIAL TOTAL		651	75,520	59,856	4,788.48

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Fremont National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Gearhart Mtn.					
Wilderness	1969-1974	0	0	0	0
	1979	2	90	60	4.80
Total		2	90	60	4.80
State/Private/BLM					
	1969-1974	98	9,860	8,145	651.60
	1975	10	1,560	673	53.84
	1976	11	2,960	738	59.04
	1977	41	4,650	1,293	103.44
	1978	30	3,070	680	54.40
	1979	87	7,360	4,403	352.24
	1980	39	2,200	2,090	167.20
Total		316	31,660	18,022	1,441.76
Total for All Ownerships					
	1969-1974	255	29,690	32,241	2,579.28
	1975	30	4,040	2,914	233.12
	1976	40	13,530	9,728	778.24
	1977	99	11,260	2,269	181.52
	1978	92	10,450	2,320	185.60
	1979	345	29,440	17,498	1,399.84
	1980	108	8,860	10,968	877.44
GRAND TOTAL		969	107,270	77,938	6,235.04
LOSSES BY 6-YEAR INCREMENTS FOR ALL OWNERSHIPS: 1969-1974 AND 1975-1980					
	1969-1974	255	29,690	32,241	2,579.28
	1975-1980	714	77,580	45,697	3,655.76
GRAND TOTAL		969	107,270	77,938	6,235.04

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Fremont National Forest Area: 1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Loss by Land Use and Ownership--					
FS	Commercial	651	75,520	59,856	4,788.48
	Wilderness	2	90	60	4.80
	Sub Total	653	75,610	59,916	4,793.28
State/Private/BLM		316	31,660	18,022	1,441.76
GRAND TOTAL		969	107,270	77,938	6,235.04
Loss by 6-Year Increment for Each District and Other Ownerships					
Bly	1969-1974	23	2,330	3,041	243.28
	1975-1980	109	9,820	5,625	450.00
Sub Total		132	12,150	8,666	693.28
Lakeview	1969-1974	71	9,470	7,641	611.28
	1975-1980	252	27,990	10,707	856.56
Sub Total		323	37,460	18,348	1,467.84
Paisley	1969-1974	42	5,500	4,939	395.12
	1975-1980	91	13,340	15,743	1,259.44
Sub Total		133	18,840	20,682	1,654.56
Silver Lk.	1969-1974	21	2,530	8,475	678.00
	1975-1980	42	4,540	3,685	294.80
Sub Total		63	7,070	12,160	972.80
Gearhart	1969-1974	0	0	0	0
	1975-1980	2	90	60	4.80
Sub Total		2	90	60	4.80
St/Pvt/BLM	1969-1974	98	9,860	8,145	651.60
	1975-1980	218	21,800	9,877	790.16
Sub Total		316	31,660	18,022	1,441.76
GRAND TOTAL		969	107,270	77,938	6,235.04

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Winema National Forest Area
1969 through 1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Chemult	1969-1974	1	160	10	0.80
	1975	1	10	5	.40
	1976	2	100	30	2.40
	1977	0	0	0	0
	1978	4	230	35	2.80
	1979	3	110	215	17.20
	1980	13	1,690	1,010	80.80
Total		24	2,300	1,305	104.40
Chiloquin	1969-1974	25	1,980	1,130	90.40
	1975	4	60	90	7.20
	1976	1	250	150	12.00
	1977	6	350	65	5.20
	1978	12	2,740	915	73.20
	1979	28	1,270	545	43.60
	1980	22	2,220	677	54.16
Total		98	8,870	3,572	285.76
Klamath	1969-1974	25	5,230	10,440	835.20
	1975	4	50	20	1.60
	1976	0	0	0	0.0
	1977	1	20	10	0.80
	1978	0	0	0	0.0
	1979	11	280	210	16.80
	1980	4	120	74	5.92
Total		45	5,700	10,754	860.32
GRAND TOTAL FOR COMMERCIAL		167	16,870	15,631	1,250.48
Mtn. Lakes Wilderness					
	1969-1974	3	80	36	2.88
	1975-1980	0	0	0	0.0
Total		3	80	36	2.88
TOTAL FOREST SERVICE		170	16,950	15,667	1,253.36

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Winema National Forest Area
1969 through 1980

District	No. of Centers	Acres	No. of trees	Volume (MBF)
State/Private/BLM				
1969-1974	56	5,640	3,275	262.00
1975	1	140	50	4.00
1976	10	2,800	1,885	150.80
1977	21	2,360	328	26.24
1978	19	4,750	3,416	273.28
1979	56	4,090	2,227	178.16
1980	40	4,160	1,243	99.44
Total	203	23,940	12,424	993.92
All Ownerships				
1969-1974	110	13,090	14,891	1,191.28
1975	10	260	165	13.20
1976	13	3,150	2,065	165.20
1977	28	2,730	403	32.24
1978	35	7,720	4,366	349.28
1979	98	5,750	3,197	255.76
1980	79	8,190	3,004	240.32
GRAND TOTAL	373	40,890	28,091	2,247.28
Loss by Land Use and Ownership				
FS Commerical	167	16,870	15,631	1,250.48
Wilderness	3	80	36	2.88
FS Sub Total	170	16,950	15,667	1,253.36
State/Private/BLM	203	23,940	12,424	993.92
GRAND TOTAL	373	40,890	28,091	2,247.28

Mountain Pine Beetle in 2nd Growth Ponderosa Pine
in the Winema National Forest Area by 6-Year
Increments of 1969-1974 and 1975-1980

District		No. of Centers	Acres	No. of trees	Volume (MBF)
Chemult	1969-1974	1	160	10	0.80
	1975-1980	23	2,140	1,295	103.60
Total		24	2,300	1,305	104.40
Chiloquin	1969-1974	25	1,980	1,130	90.40
	1975-1980	73	6,890	2,442	195.36
Total		98	8,870	3,572	285.76
Klamath	1969-1974	25	5,230	10,440	835.20
	1975-1980	20	470	314	25.12
Total		45	5,700	10,754	860.32
Mtn.Lakes Wilderness	1969-1974	3	80	36	2.88
	1975-1980	0	0	0	0.00
Total		3	80	36	2.88
State/Pvt/BLM					
	1969-1974	56	5,640	3,275	262.00
	1975-1980	147	18,300	9,149	731.92
Total		203	23,940	12,424	993.92
All Ownerships					
	1969-1974	110	13,090	14,891	1,191.28
	1975-1980	263	27,800	13,200	1,056.00
GRAND TOTAL		373	40,890	28,091	2,247.28

REFERENCES

Alexander, R. R.
1954. Mortality following partial cutting in virgin lodgepole pine. USDA Forest Serv. Sta. Pap. 16, Rocky Mtn. Forest and Range Exp. Sta., Ft. Collins, CO. 9 pp.

_____.
1975. Partial cutting in old-growth lodgepole pine. USDA Forest Serv. Res. Pap. RM-136, Rocky Mtn. Forest and Range Exp. Sta., Ft. Collins, CO. 17 pp.

Amman, G. D., M. D. McGregor, D. B. Cahill, and W. H. Klein.
1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains. USDA Forest Serv. Gen. Tech. Rep. INT-36, Intermtn. Forest and Range Exp. Sta., Ogden, UT. 19 pp.

Barrett, James W.
1979. Silviculture of ponderosa pine in the Pacific Northwest: the state of our knowledge. USDA For. Serv. Gen. Tech. Rpt., PNW-97, 106 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, OR.

Berger, John M.
1968. Timber Resource Statistics for Central Oregon. USDA For. Serv. Res. Bul. PNW 24. Pac. Northwest For. and Range Exp. Sta., Portland, OR.

Berntsen, C. M.
1975. Management conflicts in lodgepole pine. Management of lodgepole pine ecosystems. Pages 503-515 in D. M.d Baumgartner (ed.). Management of lodgepole pine ecosystems. Washington State Univ. Coop. Ext. Serv., Pullman.

Cochran, P. H. and Carl M. Berntsen
1973. Tolerance of lodgepole and ponderosa pine to low night temperatures. For. Sci. 19(4):272-280, illus.

Cole, D. M.
1975. Culture of immature lodgepole pine stands for timber objectives. Pages 536-555 in D. M. Baumgartner (ed). Management of lodgepole pine ecosystems. Washington State Univ. Coop. Ext. Serv., Pullman.

Cole, W. E. and D. B. Cahill
1976. Cutting strategies can reduce probabilities of mountain pine beetle epidemics in lodgepole pine. Jour. Forestry 4:294-297.

Dolph, R. E., Jr.
1971. Mountain pine beetle damage in the Pacific Northwest, 1955-1966, USDA For Serv., 36 pp., Pac Northwest Reg. Office, Portland, OR.

Franklin, Jerry F. and C. T. Dyrness
1973. Natural vegetation of Oregon and Washington. USDA For, Serv. Gen. Tech. Rep. PNW-8, 417 pp., illus. Pac. Northwest For. and Range Exp. Stn., Portland, OR.

Gibson, K. E.
1978. Results of a 1977 pilot project to evaluate the effectiveness of Sevin insecticide in preventing attacks by the mountain pine beetle in lodgepole pine on the Targhee National Forest, Idaho. USDA Forest Serv., Forest Insect and Disease Manage., Ogden, IT. 22 pp.
Montana. USDA Forest Serv., State and Private For. Rep. 79-5. 13 pp.

Holm, Arlie, and Terry Eccles
1980. Sheep Bridge Campground Development Alternative Plan. Environmental Assessment, Bend Ranger Dist., Deschutes Nat. For. 50 pp.

Lotan, J. E.
1975. Regeneration of lodgepole pine forests in the Northern Rocky Mtns. Pages 516-535 in D. M. Baumgartner (ed.). Management of lodgepole pine ecosystems. Washington State Univ. Coop. Ext. Serv., Pullman.

Mowat, Edwin L.
1960. No serstinous cones on central Oregon lodgepole pine. Jour. Forestry 58:118-119.

Safranyik, L., D. M. Shrimpton, and H. S. Whitney
1974. Management of lodgepole pine to reduce losses from the mountain pine beetle. Canadian Dept. of Environ., Forestry Serv., Pac. Forest Res. Centre Rep. 1. Victoria, B.C. 24 pp.

Sartwell, Charles and R. E. Stevens
1975. Mountain pine beetle in ponderosa pine: prospects for silvicultural control. Jour. Forestry 73(3):136-40.

Sartwell, Charles and R. E. Dolph, Jr.
1976. Silvicultural and direct control of mountain pine beetle in second-growth ponderosa pine. USDA For. Serv. Res. NOTE PNW-268, 8 p. Pac. Northwest For. and Range Exp. Stn., Portland, OR.

Sassaman, Robert W., James W. Barrett, and Asa D. Twombly
1977. Financial precommercial thinning guides for Northwest ponderosa pine stands. USDA For. Serv. Res. Pap. PNW-226, 27 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, OR.

Waring, R. H. and G. B. Pitman
1980. A simple model of host resistance to bark beetles. Oregon State Univ., For. Res. Lab., Res. Note 65, Corvallis, OR. 97331.